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Roman Building Materials, Construction Methods, and Architecture: The Identity of an Empire

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ROMAN BUILDING MATERIALS, CONSTRUCTION METHODS, AND ARCHITECTURE: THE IDENTITY OF AN EMPIRE

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ABSTRACT

Empires have been identified in various ways such as by the land area under their control, by their duration, their level of economic influence, or military might. The Roman Empire was not the world's largest and its duration, although notable, was not extraordinary. Military power was necessary for conquering the area brought under the control of the Empire. However, for the Romans, the ability and capacity for construction is what identified and expressed the Empire when it began and identifies the Empire today. The materials used, construction techniques employed, and architectural styles for structures for government, entertainment, dwellings, bridges, and aqueducts will be discussed. Because of the quantity of construction, the extent to which it was distributed across the Empire, and the significant amount remaining today, the Roman Empire is expressed and identified by what the Romans built, how it was built, and the architectural style employed.

Primary sources include Marcus Vitruvius Pollio whose *Ten Books on Architecture* was written between 30 and 20 BC. Vitruvius was born in approximately 80 BC and died in approximately 10 BC. Titus Livius, 60 BC – AD 17, produced 142 books on the history of Rome. Gaius Plinus Secundus (Pliny the Elder), AD 23-79, wrote his primary work, *Natural History*, during the first century AD. Sextus Julius Frontinus, AD 35-104, became water commissioner of Rome after serving as a military governor in Britain. He wrote the *Water Supply of the City of Rome* in AD 97. The authors listed above were prominent Roman citizens and were from well connected families. Pliny and

Livy wrote as historians. Vitruvius' and Frontinus' works were instructional in purpose but unwittingly became valuable historical documents.[1]

TABLE OF CONTENTS

Table of Contents (Continued)

LIST OF FIGURES

CHAPTER ONE

ROME BECOMES AN EMPIRE

> Now is the time to proceed to the wonders of Rome, to examine what we have learned over 800 years and to show that we have conquered the world with our buildings too.
>
> *Pliny, XXXVI, 101.*

With these words Pliny defines the perspective of Rome regarding the ability of their structures to state the power of the Empire. Historian John Landels explains that Roman contribution to technology was almost entirely in the field of practical application, acknowledged by Pliny in the above excerpt. Historian Henry Hodges also reinforces this position but gives the Romans credit for using ideas from elsewhere to their greatest advantage. Applying technology, as it relates to materials, methods of construction, and architectural characteristics, produced structures that became, and remain, identifiable as the Roman Empire. Architecture has the potential to convey political messages and the grandeur, splendor, and opulence of Rome conveyed *this* to the known world. A variety of structures produced by the Romans including temples, marketplaces, government buildings, baths, houses, bridges, and aqueducts all contributed to the identity of the Empire and will be discussed in this regard.[2]

The delivery of water to Rome and throughout the Empire, a requirement for the continued existence of a city, provided a visible expression of empire to Roman citizens and those of the Mediterranean region by way of structures built to accommodate the need. The Romans constructed almost 800 miles of aqueducts throughout the empire. Their visibility and architectural style achieved a grand and lasting statement of empire.

Daniel Headrick, in his book *The Tools of Empire, Technology and European Imperialism in the Nineteenth Century,* examines the application of technology as part of the explanation for the tremendous expansion of European influence during the late nineteenth and early twentieth century. There are parallels to Roman imperialism, but there is a difference in the geographical area of influence. Headrick explains that by the late nineteenth century over eighty-four percent of the earth was dominated by Europe. Although the Roman Empire exerted immense influence, the land area controlled by Rome was relatively small compared to nineteenth century European imperialism. Rome controlled a ring of territory immediately surrounding the Mediterranean Sea. To be fair, the territory did extend into what is now Great Britain, but still the Roman sphere of influence was relatively small, though its influence was great. Even though the area was relatively small, the identity of the Roman Empire expressed by its structures was far greater and endures to the modern day.

The primary motive for the establishment and expansion of empire is the need for raw materials, exerting economic influence, or exerting military influence. The means for initiating empire are military and economic power. The Romans possessed both, and the reasons the Republic became an empire are far beyond the scope of this paper. My objective is to demonstrate how Rome, having achieved empire, expressed its imperial power through its structures.

The Roman Republic became Imperial Rome with the reign of Augustus (Caius Octavius) as its first Emperor. Augustus' reign was forty one years, from 27 BC to AD 14. Sir Bannister Fletcher in *A History of Architecture* relates the boast of Augustus that

he found Rome a city of brick and left it one of marble. Fletcher explains further that Augustus initiated building, based on Republican architecture, with heavy Hellenistic influences, in order to improve the capital city of the Empire.

One individual's wishes, desires, and motivation, that of Augustus, impacted historical events, and his desire to drape Rome in marble provides one example of how the Empire came to be identified by use of a particular building material. The splendor and grandeur of Rome today, even in ruin, remains impressive. The Colosseum, Pantheon, arches, and spans of aqueducts are existing structures that produce admiration for the architectural and construction abilities of the Romans. These structures were used to expand, maintain and identify the world's most impressive empire, and are the subject of this thesis.

Today the remains of the Roman Empire across Europe are a testament not only to the architectural and construction capabilities of the ancient Romans, but also to the power and glory of the Roman Empire. (In Chapter Six, a review of selected sites will be made.) The city of Rome is obvious, as well as Italy, but equally important are other areas and modern nations of Europe where the Empire extended its reach. In the east, Vienna, Austria has maintained Roman ruins in the heart of the city. In the west, across the channel, England contains iconic Roman ruins with the city of Bath, and Hadrian's Wall. Back across the channel in France, Paris in the north, Lyon in the southeast, and Tours in central France, also contain sites.

Edward Gibbon, in his monumental work, *The Decline and Fall of the Roman Empire,* describes Rome from the 2nd century AD through its remnants into the 15th.

Because of the focus of Gibbon's work, examples of the power and glory of Rome might not be expected, but one is indeed found. In an ironic twist, the rise of Christianity which happened as the Empire began to decline, resulted in another representation of power, some of which continues today. Gibbon's description is summarized perfectly in the following quotation.

> While that great body was invaded by open violence or undermined by slow decay, a pure and humble religion gently insinuated itself into the minds of men, grew up in silence and obscurity, derived new vigor from opposition, and finally erected the triumphant banner of the Cross on the ruins of the Capitol.[3]

CHAPTER TWO

BUILDING MATERIALS

Republican and Imperial Rome was, and remains, an impressive city. Rome has been examined extensively though the centuries so the casual observer is aware of Rome and the influence it still exerts on the modern world. Rome at the time of Christ, which is coincidentally about the time of transition from Republican to Imperial Rome, was a scene of busy markets, government activities, transportation and other aspects of commerce, but more importantly, of the business of empire. In order to produce and maintain empire, facilities were necessary to conduct these activities. Construction of facilities requires materials and ways to build them. Architectural characteristics employed by the Romans combined with the materials used produced a statement of empire that is its essence.

For a city of one million inhabitants a variety of buildings would have been necessary. These will be discussed in a later chapter on architecture. The primary focus of this section is the materials and methods employed. Roman builders utilized naturally occurring materials, primarily stone, timber and marble. Manufactured materials consisted of brick and glass and composite materials consisted of concrete. These materials were available within close proximity to the city of Rome and generally throughout the European area of the Empire. Innovation related to this use of materials was indeed more a matter of seizing opportunity because materials used by the Romans had been used by preceding cultures. The use of stone and timber is basic to a primitive

level of construction. The Romans made use of these basic materials, but additionally made use of mass produced materials such as brick and concrete, allowing rapid expansion and extensive reach of the Empire.[4]

Stone

Roman builders employed the use of several varieties of stone, each valuable for certain qualities: strength, durability, and aesthetics. Stone supply was gathered locally and some quarried depending on availability. Stone served the Empire as a basic construction material. Brick and concrete were used when speed and repeatability of construction were critical.

At a basic level, stone is the most common and logically used building material. Even the most primitive culture would be expected to gather and arrange stones into some type of shelter. Likewise, it would be expected the Romans would make use of stones for construction. Based on the level of advancement of the culture, their abilities in stone masonry exhibited a high level of complexity and finish. This was achieved by use of a variety of stone cutting tools; cutting hammer (bladed), scabbling hammer (pointed), stone mason's hammer (ax), mallet, punch, chisel, saw, and square. This set of tools remains the same for stone masons in the twenty-first century.[5]

Geology classifies stones/rocks into three categories: sedimentary, igneous, and metamorphic. The Romans unwittingly utilized all categories of stone contained in the geologic strata: travertine, a sedimentary stone; tufa and granite, igneous; and marble,

metamorphic. The Romans naturally made use of these materials due to their nearby geographic distribution and relative ease of obtaining a supply. Vitruvius provided guidance for their use based on perceived qualities and attributes.

Among types of stone one of the most popular was travertine. Vitruvius recommended travertine as a stone that would “endure every strain whether it be stress or the injuries inflicted by harsh weather.” Travertine, a sedimentary limestone, is very hard and has the capacity to carry heavy loads due to its inherent compression strength. It has a creamy texture with a lightly pitted surface and was used structurally, and also decoratively for facades of buildings such as theaters and amphitheaters. Travertine’s popularity diminished when Augustus favored marble over travertine as a material for adorning building exteriors.[6]

Tufa is a porous, solidified volcanic mud, resulting in a somewhat weak stone. It was used primarily for interior construction, such as platforms for temples. Because it was not a hard stone, tufa was easily cut and was good when used in covered places, but was unsuitable for exterior uses as it was quickly eroded by frost and rain.[7]

Extensive use of marble was introduced during the reign of Augustus. Marble was quarried locally and also transported considerable distances, some as far away as Tunisia. It was highly valued and primarily used for decorated elements (such as the “capitals” of a column), or for facings. Sear and Adam provide an extensive inventory of utilized marbles: Chemtou, Chios, Flfia, Lesbian, Parian, Pentelic, Porta Santa, Proconnesus, Pyrenean, Rosso Antico and Thesian. The names of these marbles are associated with the particular location from which they were obtained. Each variety of

marble had its signature color. They ranged from yellow veined, grey-blue, white-yellow veined, white, bright white, red-blue, violet, red, and green. The sight of Rome with facades of these colors would have been striking. The application of this building material, the result of Augustus' taste and desire, provides a striking example of how materials were used to express empire.[8]

Although the use of stone by Roman builders was extensive, Vitruvius devoted little space to stone in his ten books, writing but a chapter on stone. Vitruvius recommended stone from quarries near the City and from Saxa Rubra and Fidenae because these quarries produced soft (tufa) and hard (limestone) stone, and because they were both near the city. The tufa could be cut with a saw, so was easily formed during construction. Because of this tufa was recommended for covered areas, in which it would perform well, but when exposed to freeze/thaw, heat, or water action, would crumble. Travertine (limestone), is much more durable but, according to Vitruvius, cracks and crumbles when exposed to fire. Vitruvius described a stone quarried in the territory of Tarquini that possessed "endless virtues." It could withstand freezing, fire, and storms, and could last indefinitely. Vitruvius recommended this stone highly, but the quarry was a considerable distance away so it was difficult to obtain. He did not identify the stone, but because of the characteristics he described, that is long lasting and not affected by freezing or fire, I speculate the stone he mentioned was granite. If this stone, granite, could not be obtained, limestone and tufa required a two year exposure to weather after quarrying. If they withstood this test, they were suitable for use in construction.[9]

A special characteristic of stone as a building material is that it has great strength when squeezed or compressed as in the construction of a wall, but is weak when stretched or strained (tension) as in a horizontal lintel. Because of this, when stone is used to span a horizontal space, the use of an arch is typically employed. The arch puts the stone in compression and the horizontal span can then be much wider. Consequently, the arch can provide superior strength over the lintel (un-reinforced) in any span. The significance of the arch cannot be minimized. It remains an essential architectural and constructional element today.[10*]

Wood

Wood is a common and essential material of construction. The use of wood by the Romans was expanded over that of the Greeks by wider application of use of the truss. This allowed the Romans to span larger spaces and construct buildings with larger interior spaces. The basilica is an example of a building containing this large interior hall. The truss, one example of wood construction, provided for an additional statement of empire due to the type of building it produced.

The use of wood as a building material is somewhat more difficult to verify as no extant examples are available. To verify the use of wood it's necessary to invoke a concept of the geologist, *trace fossil*, or better described in this setting as trace evidence. As a trace fossil provides evidence of the activity of an organism, whether walking,

[*] Further discussion will follow in Chapter 3.

slithering, or such, trace evidence can help demonstrate where consumable material was utilized. Photographs of various Roman structures show, for example, a wall with indentation where a riser and tread for stairs would have been. It can be speculated that these risers and treads would have been made of wood as they have deteriorated from their place of attachment. In these examples the surrounding structure is sound, which tends to demonstrate the stairs were made from a less robust material.

Pliny provided additional evidence of the use of wood by identifying the Roman inventor of woodworking, Daedalus. He credited Daedalus with the invention of several woodworking tools: the saw, axe, plumb-line and glue. This would put these inventions somewhere prior to the first century AD, since Pliny's birth was early in the First century.[11]

Vitruvius provided a useful explanation of various timbers available for construction. His advice began with the time of year trees should be harvested, that being autumn. He explained that trees are "pregnant" in spring and are not suitable for harvesting. Timber varieties available were oak, elm, poplar, cypress, fir, and alder. Vitruvius provided instruction on the use of the various timbers. Fir is described as a light wood, resists bending, so therefore would be desirable for use as joists (parallel beams supporting a floor). Oak, having a tight structure, was desirable for use where the wood must be buried in the ground, or possibly used as piers. Winter Oak is described as useful in general construction. Pine and cypress are recognized for their resins and cedar and juniper for their oils.[12]

The knowledge of timbers, when they should be cut, how long they should cure before use, and the most effective use of the varieties would have been obtained by exhaustive trial and error or passed to Vitruvius (and his associates) from preceding generations. It is not evident through his writings which method provided the information.

It must be noted that Vitruvius referred to the qualities of timber and stone with how much each contains of the four elements: earth, water, fire, and air. The oak, for example, is saturated with "earthy first elements," which provides its tight structure and resistance to moisture. This was the science of the period, originating with the Greeks and Pythagoreans.[13]

Glass

Glass was an ancillary construction material for the Romans, not absolutely required for building the structure. The use of glass until the late first century AD was mostly for vessels and art. The introduction of glass for window glazing was a fundamental shift in the concept of the window. It provided the Romans with an additional building material and architectural feature as an aesthetic statement of empire.

Glassmaking was discovered in the Near East sometime around 2300 BC Early glass uses were mostly for beads and inlays, and later glass vessels. Pliny relates an interesting story about the discovery of glass. "A ship belonging to traders in soda once

called here," so the story goes, and they spread out along the shore to make a meal.[†] There were no stones to support their cooking pots, so they placed lumps of soda from their ship under them. When these became hot and fused with the sand on the beach, streams of an unknown translucent liquid flowed, and this was the origin of glass." Pliny's account does not provide an estimated date for the discovery, so Luckner's will have to be accepted.[14]

Vitruvius did not address glass in his ten books, neither in the book on materials or in the book on finishing. The primary consideration for this writer is its use as a building material, and that use would be for windows. Numerous photographs of extant Roman structures are available, as are renderings of Roman buildings as they would have appeared at the time of completion. The extant structures have openings that are clearly recognized as windows. The renderings also show openings recognizable as windows, many of these depicted with mullions.[‡] Further, Pliny identified the most highly prized glass as transparent. Sear states that window glass began to be used in the late first century AD, providing an estimated time for the use of window glass.[15]

Brick

Several categories of materials have been examined thus far but the building materials that were the workhorses for the Romans were brick and concrete, providing mass produced, quickly assembled and uniform building materials. First discussed is

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[†]The preceding paragraph would indicate the location to be in the Near East.
[‡] Strips dividing window panes.

brick. Upon visiting Rome, this writer was surprised at the amount of brick construction in the remains of the City. That brick construction also features great complexity and intricate work which is displayed in arches and walls.

Brick, formed from clay, was originally, and remains, a primary building material in parts of the world where vegetation is scarce, and particularly in the regions of the Mediterranean. The use of brick is worldwide and its use continues to the present. Sun-dried brick was adequate for use in most areas, but by accidental discovery it became known that baked brick was impervious to water. Baked clay's initial use, up to the first century BC in Rome, was for roof tiles to provide protection for timbers and masonry work. In other Mediterranean regions baked bricks were used only for watertight construction, or for the most exposed parts of buildings. Vitruvius reinforces this timeline by his reference to mud-brick, limited in the City due to restrictions imposed by limited space. He also provides instruction on the application of roof tiles over brick masonry construction, instructing that the roof tiles should project over the masonry, like a cornice. The projection of the cornice will cast dripping water beyond the plane of the brick masonry, protecting it. It will become apparent over time if the tiles have protected the brick. Through these instructions, Vitruvius confirmed mud brick was still in general use in Rome in the first century BC. He also confirmed that baked tiles were being made at that time, and with this example demonstrates their vital purpose.[16]

Unbaked bricks were made by mixing clay with water in a small pool, the mixing done by foot. A hardening agent was added to the mixture and this could be straw, dried grass, cereal chaff, and sometimes sand or gravel. The fluid material was put in place in

frames and tamped to remove excess moisture before drying. The manufacture of unbaked bricks follows the same procedure with regard to mixing the clay, but rather than construct in framework, the material is placed into pre-prepared molds and is allowed to dry. The drying process was critical and, according to Vitruvius, must be limited to autumn and spring. Drying in sun or too hot a temperature resulted in an uneven drying process causing the bricks to crack and crumble.[17]

Three standard sizes of bricks were made by Roman manufacturers: lydium, 11.65” x 5.8”, tetradoron, 11.65” x 11.65” (four hands), and pentadoron, 14.5” x 14.5” (five hands).[§] This contrasts with the size of a modern residential brick which is 8” x 3.5”. The pentadoron size brick was most useful in the construction of large buildings and city walls where large sections could be completed quickly. The visual impact of the construction with the wider Roman brick is impressive. The two-thousand-year-old construction has a strangely modern look, as was observed and is the opinion of this writer.[18]

The hardening agent to be used in baked bricks must be sand, as the firing will destroy straw, grass, or other vegetable matter used in mud-brick manufacture. Brick was fired in a kiln, which is similar to a potter’s, only larger. A fuel chamber was a few feet below the ground surface, which allowed the loading door for the material to be at ground level. This door was sealed off completely during firing. Wood, grass, and husks were used as fuel. A complex series of chambers and vents allowed operators to control the level of heat, which could range from 840 °F at the exit, to 1470 °F in the main firing

[§] Sear lists the size of lydium as 17”x 11”.

chamber. Bricks in the upper area (lower temperature) were usually rejected for building work as they would not solidify and returned to powder. Another method of firing is in a stack. This just requires the material to be stacked, the outer layers becoming a quasi kiln. This method is used now, but it is not certain the Romans or Greeks used this method.[19]

Exactly when the Romans began to use baked brick remains unsettled. Landels, Hodges, White, and Sear estimate that it was probably sometime during the first century AD. Vitruvius referred only to mud bricks, but did refer to baked tiles, providing reinforcement for the introduction of baked brick during the first century AD. The distinction should be noted that the remaining examples are of baked brick. Vitruvius' instructions referenced what the technology of his time made available, which was unbaked brick.

As an expression and statement of empire, brick was a primary contributor. Brick allowed rapid expansion of the city of Rome and the construction of other cities, fortifications and aqueducts. This was made possible due to manufacture of brick, which could be supplied to the available labor. When the use of baked brick was introduced, the Empire now possessed a building material that not only provided a quick means of construction, but also one that would last. Mud bricks would deteriorate with the passing of seasons and time, but baked brick could endure for centuries. The primary consideration for expression of empire is the repeatable nature of construction due to its uniform size, resulting in quick assembly and aiding expansion.

Concrete

Concrete provided the Romans with a means for producing a variety of structures with strength, flexibility of design, and in certain formulas, provided unique capabilities. Concrete could be formulated repeatedly and uniformly. Employing skilled workers, concrete provided the Romans a versatile, practical material for expanding the empire.

Vitruvius began his instructions concerning the mixing of concrete by advice regarding the types of suitable sands, an essential ingredient in its production. Black, white, light red, and dark red were recommended and should not contain any earth mixed in. It could be determined if it is free of earthy material if it crackled between one's hands when rubbed together, or if it did not leave residue when thrown into a white cloth. Vitruvius recommended excavated sands from newly opened beds. Beds that had been open for a length of time would result in sand contaminated by earth. Sand from the seashore was not recommended because it was hard to dry and the resulting walls would not support a load without being reinforced.[20]

Lime mortar is the initial component for concrete. The Romans had developed a strong mortar by the late third century. To produce a lime mortar according to Sear:

> [q]uicklime (CaO) is obtained by burning limestone ($CaCO_3$). The lime is then slaked (crumbled into water) to produce calcium hydroxide, $Ca(OH)_2$ and is mixed with sand. On evaporation it forms crystals of $CaCO_3$ or calcium carbonate, and so the cycle is complete. The crystals have a tendency to adhere to something rough and hard, so the addition of sand to a certain ratio actually increases the strength of the mortar. Vitruvius recommended three parts of sand to one part of lime. [21]

The preceding formula is a fairly complicated process and the Romans, according to Hodges, were not the first to employ its use, although he does not offer the origin, nor does Vitruvius.

The most effective and useful type of concrete produced by the Romans was that made with a volcanic silica material called pozzolana, so named because it came from the town of Pozzouli, near Naples. It was collected from the effluent of nearby volcanoes. Modern concrete makes use of natural or artificial silica material. “If lime and pozzolana are mixed in the proper proportions, they form a substance know as hydraulic cement. The process of setting is due, not exclusively to evaporation, but to a chemical action in which lime and pozzolana are converted into a third substance. This cement/concrete is capable of setting even under water.” With concrete that would “set” underwater the Romans truly had created a unique ability. They could not only build in damp or low lying locations, but could also build artificial harbors, the foundational remains some of which still remain today.[22]

The most puzzling aspect of Roman concrete construction is not that the Romans made excellent use of this material, but rather that it was forgotten during the Middle Ages and only rediscovered in 1756 when a British engineer was commissioned to rebuild the Eddystone Lighthouse in Cornwall. The engineer, needing a material that would set and remain stable underwater, discovered the formula in an ancient Latin document.[23]

Concrete and brick share equal importance in the expression of empire in my view. Concrete allowed the Romans flexibility, variation and durability in constructing

vaults, arches, and walls. Concrete made with pozzolona cement, with its ability to cure underwater, was the most significant, allowing for artificial harbors, bridge foundations and other structures requiring foundations in water. These types of structures were essential components of empire.

Finishing

Vitruvius provided a brief discussion on finishing materials: plaster for walls and ceilings, and paints for any applicable use. Paints produced from ores and sea life were also discussed. Two colors are of special note. Blue pigment was obtained through a complicated process involving sand, potassium nitrate and powdered copper. This mixture was put into a kiln and the chemical process yielded the blue pigment. Purple was described as the “most prized and most outstanding, loveliness of appearance.” Purple, Vitruvius explained, was obtained from the sea mollusk, and only those from the island of Rhodes due to its location relative to the sun. Viturvius did not provide the origin of these formulae or procedures for obtaining various pigments. This brief discussion of plasters and paints is important as recognition that these materials were used. Their significance to empire was minimal yet from an aesthetic perspective added to the imperial personna, especially purple, signifying royalty.

CHAPTER THREE

METHODS OF CONSTRUCTION

Brick and concrete became basic materials of construction for the Empire, but to be fully utilized it was necessary that efficient and usable methods of construction be developed for their use. The following descriptions explain techniques for use of these materials.

In using concrete for construction, the initial step is preparing a foundation. Typically for modern construction involving large structures, the foundation is placed on bedrock. Investigations of Roman structural remains have identified a fairly standard type of masonry foundation. This consisted of large stone rubble, with mortar to a depth of about three feet. This is a fairly shallow foundation, but most of the Roman buildings were not of great height. Since this type of foundation is common in Roman ruins, the type of structure a remaining foundation supported cannot be identified.[24]

Roman concrete construction was identified according to its facing, and three methods were used: *Opus incertum* (uncertain work), *opus reticulatum* (network), *and opus testaceum* (brick work). The method employed a fill of concrete between walls with facings of the three types mentioned above. Walls were about two to three feet thick.[25] (See Figure 1.)

Opus incertum was the earliest facing type developed. It consisted of irregular, all-purpose stones probably gathered in the area of the building site. The earliest evidence of opus incertum was discovered in Pompeii and Palatine dating from the third

century BC. Numerous fortifications and walls, dating from the second and first century BC provide good examples of opus incertum construction but its use declined during the first century BC. This decline was brought about by the economic and population growth of the Republic from around 50 to 20 BC (which occurred at the same time as the beginning of Imperial Rome).

Growth brought with it a need for production of prefabricated components of construction and this need was met by the development of standardized stones, and later brick. Opus retciulatum continued the use of stones, but they were hewn to a standard size prior to being supplied to the construction site. The stones, when prepared for use, were about 3.5” to 4” square and were laid on the diagonal. Opus incertum employed a random arrangement, and in opus testaceum bricks were laid on the horizontal. As opus reticulatum replaced opus incertum, the job of the laborer became easier and actually made the laborer’s job more of an assemblyman than a craftsman. The search for and selection of stones during the construction process was reduced and the focus became one of preparing mortar and laying stones.[26]

The transition from opus incertum to opus reticulatum began with a facing known as quasi-opus reticulatum. In this facing the stones, while they were laid on 45 degree angles, were not all hewn to the standard size and in some cases, even in the same construction, reverted back to opus incertum. An example of this is in the great cistern of the Forum Baths in Pompeii, constructed in the first century BC, where the construction begins as quasi-opus reticulatum and slowly changes to opus incertum in the upper levels of the construction.

Sear cites samples of opus reticulatum back as far as 117 BC in Rome and Vitruvius confirms the use of opus retiulatum in the last few decades of the first century BC, saying "[it] is used by everyone now." Sear also reinforces Adam's argument that opus reticulatum was the result of growth of the Republic due to the need for standardized building materials. Consequently, a sort of "industrialization" resulted because of a need for construction speed. Vitruvius also commented on the pleasing appearance of opus reticulatum, and the available photographs of extant examples reinforce Vitruvius' opinion. The diagonal positioning of the stones provides a unique and pleasing appearance, depending on one's taste. White's description of opus retriculatum doesn't stress the uniformity of the stones, nor the diagonal presentation. White does reference the use of pozzolona cement, and also references Vitruvius's comments regarding the superior appearance of reticulatum. Opus reticulatum was used throughout the first century AD when its use declined for the same reason it had replaced opus incertum: standardization of building materials.[27]

"The strongest visual memory left in the minds of those who have visited Rome and its vicinity is one of the monumental body of brick from which there emerge, now and then, some isolated remains of travertine or marble." [28] That was certainly the case with this writer upon visiting Rome. The remaining amount of brick construction from the perspective of the observer of ancient Rome is surprising. When a study into the manufacture and extent of use is initiated, it becomes even more impressive.

The use of opus testaceum, or brick work, began during the latter part of the first century AD, but reviewing White, Sear, and Hodges, there is a consensus that no specific

date can be fixed where brick was introduced into the architecture of Rome. We do know that opus testaceum followed opus reticulatum and opus incertum in order as the need for standardized building materials increased, and as the technology to produce them came available. By the end of the first century the Romans had begun to use baked brick, and a reliable manufacturing process for producing them had been established, which has been discussed earlier. The two most notable structures from this period, constructed of concrete, with brick facing, are the Colosseum and Trajan's Markets. The brick masonry of the Colosseum is especially impressive with the supporting tiered arches formed of intricate brick work, including keystones, observed by the author. In addition to the Colosseum and Trajan's Markets, other notable buildings constructed of opus testaceum were: the Pantheon, 118 through 25 BC; the Tomb of Hadrian, finished in AD139; the Baths of Caracalla, AD 212 through 216; the Basilica of Maxentius, begun in AD 306. This is only a partial listing and is used to demonstrate that the use of opus testaceum was the favored building method from the first century AD throughout the remainder of the empire.[29]

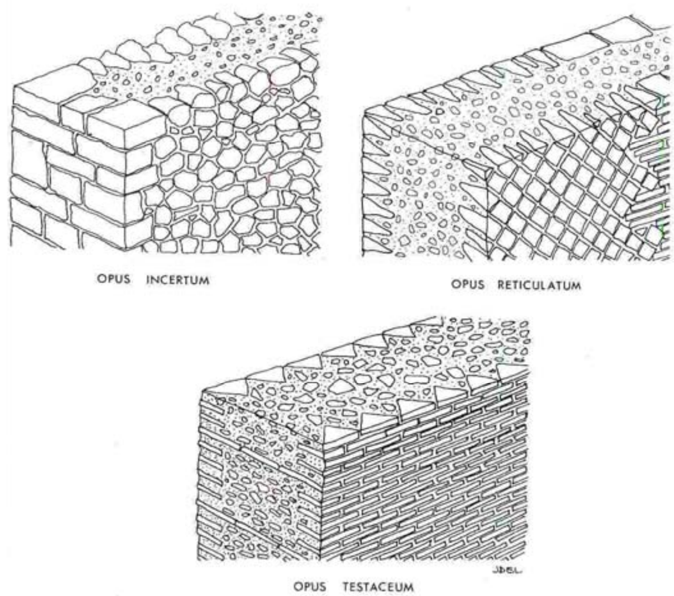


Figure 1: *Opus Incertum, Opus Reticulatum,* and *Opus Testaceum*. (Sear, *Roman Architecture*, 76)

Arches and Vaults

K. D. White begins his discussion on Roman arches and vaults by proclaiming it a more remarkable technical achievement than the manufacture of brick or use of concrete. This writer disagrees with him and considers brick and concrete construction to be the monumental achievement of the Romans because of the great volume of construction made possible by these two materials. The recognition must be made that the Romans were not the inventors of the arch and vault. Adam credits the Tarquins, a faction of the Etruscans, with the invention of the arch and vault in the 6^{th} century BC. The Etruscans, the predecessors of the Romans, inhabited an area north of what is now Rome. According to Boyd, the origin of the use of the arch in the Greek world can be dated with certainty to the late fourth century BC, and more specifically to use of the arch by the Macedonians. He further relates that Macedonian military engineers learned of the arch and vault in Mesopotamia, where its use had been know for at least two preceding millennia.[30]

The sources used for this paper make occasional reference to the Etruscans, but little is made of them beyond that. Whether or not they invented the arch and vault is in doubt as Boyd, as stated above, credits its origin to Mesopotamia two millennia earlier, and White to the Egyptians in the sixth century. This is a debate far beyond the scope of this paper, but even though the Romans did not invent the arch, they made significant use of it as a method of construction. Arches and vaults were initially constructed of stone. The wedge shaped stone components were known as voussoirs. Stone used for a span

required construction by way of an arch because of the relatively weak tension strength of stone, as discussed earlier. The voussoir distributed the load laterally, converting it from tension to compression. Another way of constructing arches was the repeatable method of using a form for poured concrete. This and the use of mass produced brick with skilled masons were the ways the Romans expanded the use of the arch.[31]

Typical concrete construction involved the building of shuttering (wooden sides) to hold the concrete in a "form" until it had set. The use of concrete in an arch or vault would be an entirely different matter. White cites recent studies (his book was written in 1984) that speculate that the use of concrete for arches was advanced by trial and error. It is speculative as to how many failures might have happened in order to advance the technique.[32]

The arch and the vault are essentially the same concept. The arch was, and remains, used in openings, doorways, and bridges. One of the most visible uses of the arch by the Empire was in the construction of aqueducts. The barrel vault is simply an arch increased in depth and is seen in ceilings, the construction of which required a complex reinforcing framework to hold the concrete or plaster in place while setting.[33]

Vitruvius also provided instructions regarding how a vaulted ceiling should be constructed:

> Place straight battens (strips of wood for nailing) at an interval of no more than every two feet, and these should be preferably of cypress, because silver fir will deteriorate quickly with rot and age. When these battens have been set in a circular pattern, they should be secured by a row of chains to the joists, or, if under the roof fixed with closely set iron nails, and these kind of chains should be made of a kind of wood that neither rot nor age nor dampness can harm, that is, from boxwood, juniper, olive, oak, cypress, and others like this except for ordinary oak,

> because its twisting creates fissures in the projects that employ it.
>
> Once the battens have been placed, then, with a rope made from Spanish broom, bind pounded Greek reeds to them as the design dictates. Then, on top of the ceiling, a mortar of lime and sand mixed together is laid on immediately, so that whatever seepage falls from the beams or the roof will be contained. But if there is no supply of Greek reeds, then narrow swamp reeds should be bundled together, and with a silken cord they should be adjusted to the proper length and thickness by attaching one to the next, provided that there will be an interval of no more than two feet between two knots of the attachments. These should be bound to the battens with a rope, as described earlier, and wooden pegs driven into them. Once the ceilings have been laid out and interwoven, their lower surfaces should be plastered, then sanded, and then polished with chalk or marble.[34]

These instructions from Vitruvius provide excellent insight into one of the methods of construction employed by the Romans. He explained a complex method of constructing a delicate and essential structural component.

The Romans employed a variety of building materials and methods of construction from simple to complex providing a lasting expression of empire. At a basic level, the use of stone and wood are logical, gathered and arranged into structures by even a primitive culture. At a more complex level are manufactured brick and concrete. Opportunities for expression of empire exist with both. With stone, in my view, the primary opportunity is the aesthetic impact of marble. Brick and concrete provide an even greater value for expression of empire due to the volume of construction that could be accomplished with these materials. The use of the arch became a highly recognizable and utilitarian architectural component for the Romans. Although not originated by the Romans, it was put to great use as a method of construction and remains a visible remnant of the Roman Empire throughout the Mediterranean.

CHAPTER FOUR

ARCHITECTURE

In the previous section the relationship between Roman building materials and its relationship to the expression of empire was discussed. The selection and use of materials also express empire although in an understated, even inconspicuous way. Certain materials provided more opportunity for expression because of their unique qualities. The architecture of the Roman Empire provided an obvious, deliberate expression of empire.

A brief word regarding influences on Roman architecture is necessary because references to origins will be made, so influence does have some relevance to the objective of the paper. Fletcher attributes the primary influence on Roman architecture to the Etruscans, the inhabitants of west-central Italy from an unknown time until they were assimilated into the Roman Republic. The Etruscans do not receive the attention paid to them that the Romans and Greeks do, but Fletcher credits them with the earliest use of the arch in Italy, even in all of Europe. Sear also acknowledges the early Etruscan influence on Rome, but provides the additional recognition of the obvious Greek influence as Greece was brought under Roman control in the middle of the second century BC. This reinforces the widespread opinion that one of the Romans' strengths was their ability to achieve maximum practicality by the application of other culture's technologies.[35]

A wide range of buildings was required by Rome to advance the Empire and to maintain it: commercial buildings and markets for economic activity; government buildings and courts for the activities of government and law; jails, regrettably for lawbreakers and those who refused authority; treasuries; temples for honoring the gods and according to Livy, the might of Rome itself; facilities for entertainment and recreation, made possible due to the wealth of a mature culture; domiciles, of necessity; bridges, allowing travel and movement of armies; and aqueducts, providing the essence of life and level of civilization, as only the Empire could. Each type of structure provides an opportunity for the expression, statement, and identity of empire. A review of each and their contribution to empire follows.

Architectural Elements

Roman architecture retained the Etruscan character for some time after the founding of the Republic, but by the third century BC began to derive much of the external design features from the Greeks. Vitruvius (30-20 BC) referred to Greek principles and terms throughout the Ten Books on Architecture. By the second century BC the Romans had developed some identity of their own, but their continuous development of materials and methods of construction progressed into the second century AD.[36]

The Romans adopted the columnar style of the Greeks and, as previously noted, the arch and the vault from the Etruscans. The Romans combined the column, beam and

arch as an architectural style, employing a faced half-column as an integral component of the structure. The half-column type of construction is employed in the Colosseum. In the construction of the aqueducts, the arches are supported on their piers without a facing column. This was in contrast to the Greek practice of using the column as a structural component. The Romans employed the structural column in the construction of temples, the surrounding colonnade being an example.

The Corinthian, Doric, and Ionic Orders were used by the Romans, not surprisingly originating with the Greeks. The Orders are referenced because they are an essential element in Roman architecture. Vitruvius devotes a chapter in Book Three and chapters one through three of Book Four to giving instructions in great detail for the production of the three Orders. Generally the Order is identified by the columnar capital, or ornament with which it is associated. (Figure 2 provides examples of each.)

The ability to span large spaces was an essential element of Roman architecture. The Greeks had been limited to spans of what could be achieved by the use of simple wooden beams, and like stone, the tension strength was low so in order to span a large interior area vertical support beams were required. The truss, originated around the third century BC by the Greeks, was adopted by the Romans and was employed in timber roof construction, eliminating the need for vertical supports. The basilica was a prime recipient of the timber truss. Construction of the large hall of the basilica became possible.[37]

The portico, a feature recommended by Vitruvius as a weather shelter for theater goers, was also incorporated as an entrance cover for circular temples. His

recommendations for temples were specific: “The proportions and symmetries of the columns do not follow the same principles as I described for temples, for these dimensions should have one type of dignity in the sacred enclosures of the gods, and a different, lighter appearance in porticos and other projects of the sort.”[38]

As an architectural element, the arch was employed prominently. It was used in various types of structures: amphitheaters, theaters, bridges, aqueducts, circuses, baths, villas, palaces, and domus. The arch’s ability to carry loads, its beauty, and the ability to construct it quickly made it one of Rome’s most recognizable architectural features.

Roman architectural elements were derived from Greek and Etruscan influences. The column, the vaulted roof, the arch, the style of the entablature and architrave, and the Orders, were all used to produce a uniquely Roman style of architecture. Organizations today, desiring to express wealth, power, and stability, will still employ the Roman character in the designs of their structures.

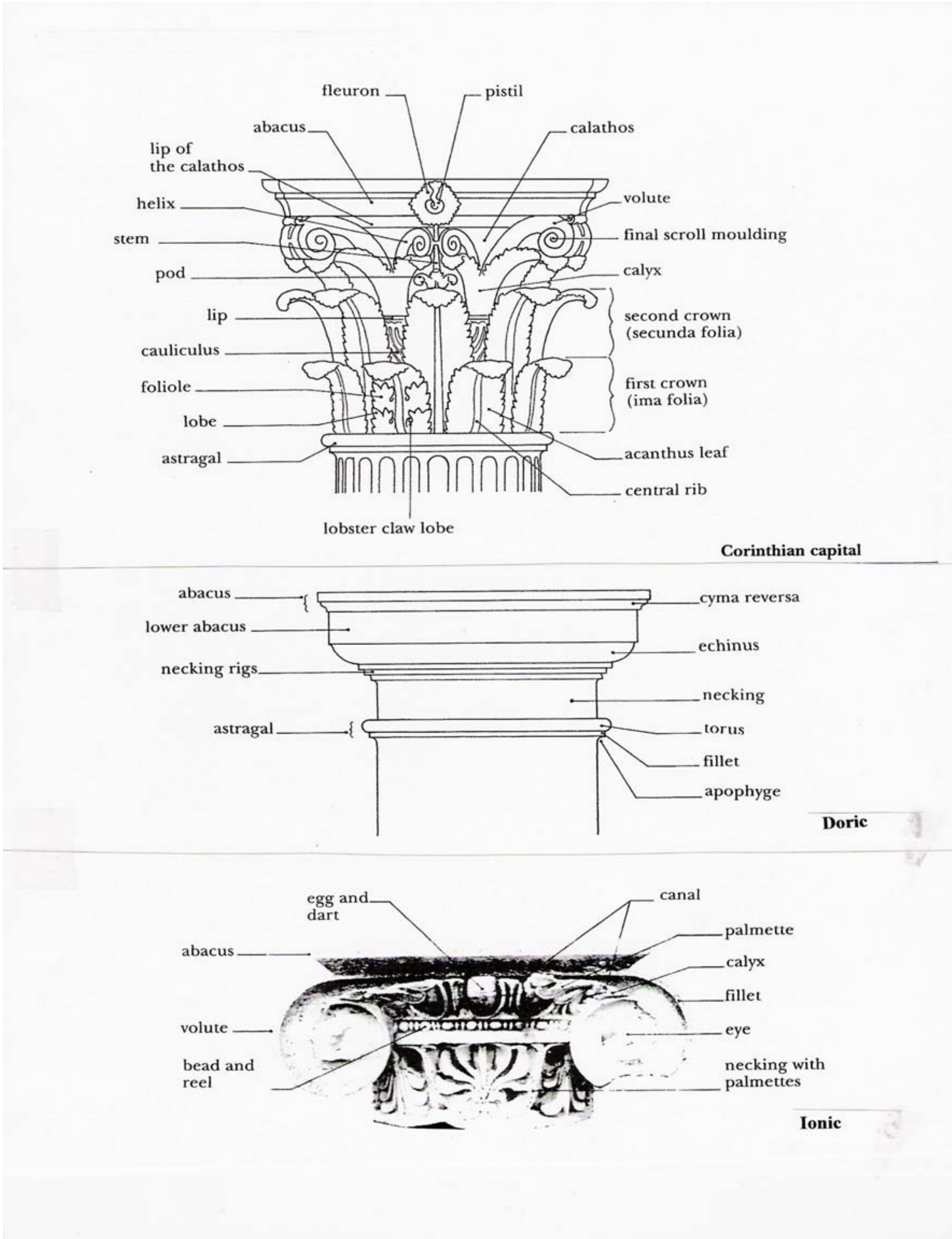


Figure 2: The Corinthian, Doric, and Ionic Orders. (Adam, *Roman Building*, 329-330.)

CHAPTER FIVE

TYPES OF STRUCTURES

Materials, methods, and architecture are ultimately expressed in structures. The following chapter discusses the various types of structures produced by the Romans.

Forums

The forum was a central open space used as a meeting place, market, or gathering place for political discussion or demonstration, a central city location critical for communicating ideas and news.

The forum was comprised of several public buildings that included markets, courts, jails, and government facilities. Forums were not only found in Rome, but also in small towns. Many of these were not built in the symmetrical style desired in Rome. Vitruvius' recommendation was that the forum be built sized to the population, so it would not be cramped, or not look deserted if built too large. The Forum Romanum, the most important in the city of Rome, was in the valley between the "hills" of Rome. Forum Romanum was an all purpose forum, not built perfectly rectangular. As an all purpose forum, the Forum originally contained shops, displays, and even some sporting contests which were later removed and relegated to the theater and the circus. The Forum, with its porticos and colonnades surrounded by temples and basilicas, would have presented an impressive sight.[39]

As the empire grew, successive emperors had forums built, not only for the greater need for additional civic space, but also as monuments to themselves. Julius Caesar (prior to the Empire) added the first, then Emperors Augustus, Vespasian, Nerva, and Trajan. Trajan's forum was the largest of these, consisting of the forum, a colonnade containing shops, a marketing area containing more shops, a basilica, two libraries, and the Temple of Trajan. The forums of Rome provided an early sort of town planning as there were forums in other parts of the Empire including Palmyra, Samaria, Damascus, Antioch, Baalbek, and Borsa in Syria; Pergamon in Asia Minor; Timgad and Tebessa in North Africa; and Silchester in England. All of these were built with colonnaded streets to provide shelter from weather.[40]

The forum provided an expression of empire in an unsuspecting way. The forum was the equivalent of today's city center. That the forum was emulated throughout the region does reflect on the influence of Rome and indicates how the empire standardized its town planning, and that Rome was powerful enough to exert this influence.

Temples

The temple was a place for personal vows, ritual ceremonies, advertising state acts, deeds and documents. The temple provided a means of informing the public of what was going on in government, the military, and other official organizations. Additionally, and most importantly for their role in empire, the temple was a symbol of authority, and as Livy described, worthy of kings and men, and the might of Rome.[41]

Roman temples were rectangular and circular. Rectangular temples were built in the style of the Greeks with a podium and portico. Greek temples were normally twice as long as they were wide, but Roman temples were shorter in proportion. Most rectangular Roman temples were simple structures compared to theaters, amphitheaters, and baths, but temples are good evidence of how Roman construction could cover large spans without the aid of supports (50 to 60 feet). Vitruvius devoted two of his *Ten Books* to the design and construction of temples. His first admonition concernd symmetry.

> The composition of a temple is based on symmetry, whose principles architects should take the greatest care to master. Symmetry derives from proportion, which is called *analogia* in Greek. Proportion is the mutual calibration of each element of the work and of the whole, from which the proportional system is achieved. No temple can have any compositional system without symmetry and proportion, unless, as it were, it has an exact system of correspondence to the likeness of a well formed human being.[42]

Vitruvius relied heavily on Greek precedence in his instructions on temples, citing Greek knowledge in ten specific instances, and half of one chapter to explain the Greek basis for the use of numbers. This reinforces the Greek influence in Roman architecture. Roman temples differed from Etruscan and Greek in that they were set to face their associated forum with emphasis on the steps and portico. Greek temples were usually faced to the east, and Etruscan temples to the south.

Examples of Roman rectangular temples include the Temple of Fortuna Virilis, Rome, constructed 40 BC, which retains the Etruscan deep portico style, but otherwise shows mostly Greek influence, using the Ionic Order. There is also the Fortuna Virilis which is constructed primarily of travertine stone, but also employs tufa for portions of the entablature and concrete for the core of the podium.

Another example is the Temple of Mars, Ultor, Rome, constructed between 14-2 BC. This temple was in the Forum of Augustus and was one of the largest and finest of Rome and was dedicated to Mars the Avenger to fulfill Augustus' vow to avenge the death of Caesar. The Temple of Mars was attached to the forum wall, an unusual practice for temples, and employed Corinthian capitals and was constructed of stone and faced with marble. The marble facing demonstrates the claim often made that Augustus left Rome a city of marble.

Pliny offered a comment regarding the Temple of Mars and its iron decorative goblets: "Nature's kindness has curtailed the power even of iron by exacting the penalty of rust, by this foresight making nothing in the world more perishable than that which is most hostile to mortals." With this comment Pliny provided insight into two areas. He confirmed the use of iron as a building material, although apparently for aesthetic reasons, and he acknowledged the Romans dreaded the use of iron as a weapon.[43]

Another example is the Temple of Concord in Rome, constructed between 7 BC – AD 10. The unusual feature about the Temple of Concord is that it is wider than it is deep as a result of its location.

Another example is the Temple of Castor and Pollux, also in Rome, which was constructed between 7 BC – AD 6. The outstanding feature of the Temple of Castor and Pollux is its clever use of lion heads as a means of evacuating rain water from the roof.

And finally there is the Maison Carree which is in Nimes, constructed in 16 BC. The Temple Maison Carree is still in existence and complete. It is a perfect example of the Greek-Etruscan design incorporated into Roman architecture. Maison Carree

incorporates the rectangular shape in the proper proportions and has Corinthian capitals and a raised podium. The Corinthian columns support an entablature with a tendrilpatterned frieze and a modillioned cornice. The architectural features listed for the Maison Carree were employed to some degree in all Roman temples. The diagram on the next page from Jean-Pierre Adam's study provides an excellent resource in understanding the detail incorporated into the design of Roman temples. These features, along with the arch, were the dominant features of Roman architecture.

Other notable rectangular temples are: the Temple of Diana, Nimes; the Temple of Venus, Rome; the Temple of Antonius and Faustina, Rome; the Temple of Saturn, Rome; the Temple of Jupiter, Baalbek; and the Temple of Bacchus, Baalbek. These temples all reflect the podium, portico, and the colonnade design of the other rectangular temples.

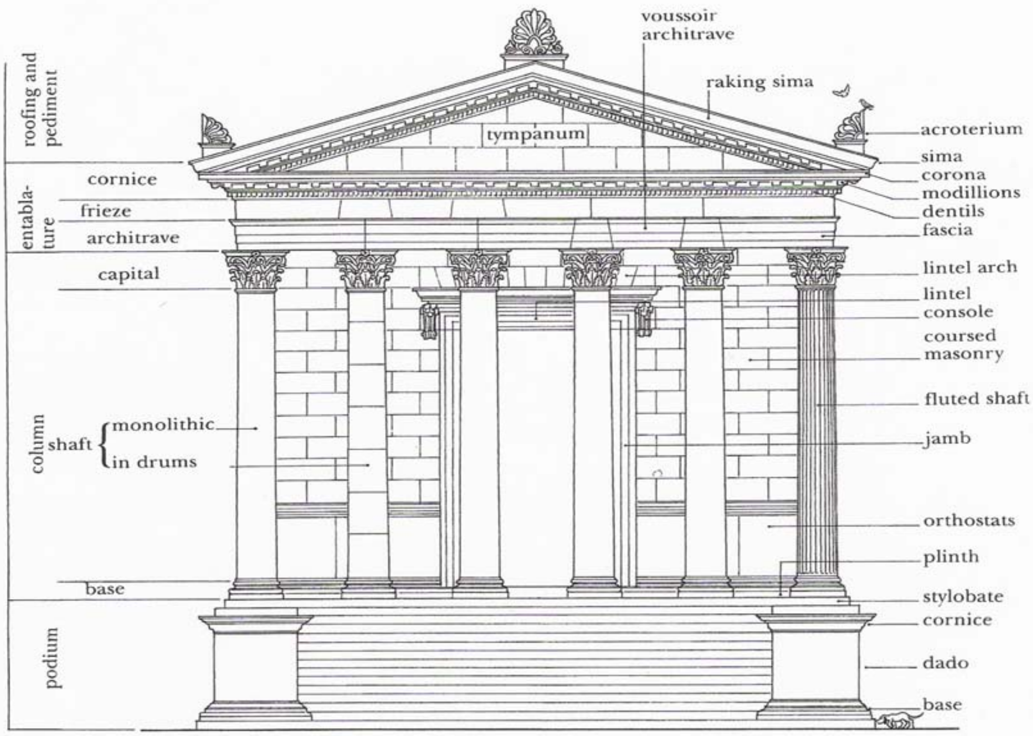


Figure 3: Architectural Features and Proportion on a Temple Façade. (Adam, *Roman Building*, 332.

The Romans also built circular temples, the most sacred of which was the Temple of Vesta, Rome, AD 205. The Temple of Vesta, guarded by the Vestal Virgins, kept the sacred fire which signified the center and source of Roman life and power. Interestingly Vesta was destroyed by fire and rebuilt several times. Vesta was constructed with a podium and colonnade and was similar to rectangular temples, but obviously different in being circular.

The best preserved building of ancient times is the Pantheon. The Pantheon was built in two different periods. The first as an open space by Agrippa, the son-in-law of Augustus, and was completed in 25 BC. The famous rotunda was added by Hadrian between AD 118 and 125. The Pantheon employs the use of the dome, another of Rome's significant architectural features. The Pantheon, however, is a unique structure in several ways. The construction of the dome of the Pantheon at a diameter of 143.5 feet is an accomplishment that has never been equaled. As one of twenty-four significant domes constructed throughout Europe only St. Paul's in London (138 ft.), the Cathedral of Florence (139 ft.) and St. Peter's in Rome (138 ft.) come close to the unsupported diameter of the dome of the Pantheon. These other three domes were constructed during the 17th, 15th, and 16th centuries respectively. It was not until the second half of the twentieth century that a dome of greater diameter was constructed, but then only by making use of steel reinforced concrete.[44]

The portico of the Pantheon is supported by un-fluted columns of granite with Corinthian capitals. The pediment originally contained a bronze relief. The building's

foundation is 14-feet-9-inches deep and the walls below the dome are constructed of brick faced concrete (opus testaceum). The interior of the dome relies on a coffered surface to reduce the weight of the concrete while maintaining its strength. Lighting for the interior is provided by a single unglazed opening in the crown of the dome.

The Pantheon has survived 1800 years intact. Various elements have been removed for use elsewhere, and were usually replaced with inferior materials (e.g., bronze plates on the lower dome replaced with lead) but it remains as an outstanding example of the splendor of Rome.[45]

The temples of Rome provide, in fact, an especially powerful expression of empire. Temples were monuments to religious gods and also monuments to the Emperors themselves, who each desired his own temple. The majority of temples were constructed between the first century BC and that latter part of the second century AD in what was the most influential period of Rome. Additionally, temples served as a means of communication, as a repository of civic documents, and as a place for recording public events. The temple then was a vital component in providing organization to the empire, a necessity in its expansion and maintenance. The most impressive of these temples is the Pantheon, which still stands today, eighteen centuries after its completion, as an expression of Rome’s power.

Basilicas

The basilica was a large rectangular hall usually twice as long as it was wide. Basilicas were halls of justice and commercial marketplaces and were a place of high importance in Rome. The large interior hall was flanked by aisles with galleries above the aisles. For law purposes, the court officials sat upon a raised dais in a semi-circular apse (a circular extension of the rectangular hall). The roof of the basilica was trussed, rather than a dome, but still covered the large expanse of the hall due to the Roman knowledge of truss construction. The Greeks had begun to timidly employ the concept of the truss, but the Romans were able to use it more effectively. Spanning the large hall of the basilica without the use of support beams required some courage initially. The exterior was simple and unadorned, compared to typical Roman architecture.

One important example is Trajan's Basilica, Rome, AD 98-112. Built by Apollodorus of Damascus, it was attached to and entered from Trajan's Forum, and was adjoined by Greek and Latin libraries. The internal height was 120 feet and the roof was timber truss, a typical construction for basilicas. Another example of the basilica was the Basilica of Constantine, Rome. Adjoining the Forum Romanum the Basilica of Constantine was unusually large at 265 feet long by 83 feet wide. But more notable is the time of construction, AD 310-313, which places it in the latter days of the Empire. Because of this some changes in construction methods and architecture begin to emerge. The design element of intersecting vaults being supported by a receiving pier, a

forerunner of the Gothic structure, is incorporated into the construction of the Basilica of Constantine. This design concept is also later utilized in Constantinople.[46]

The basilica expressed empire in a way similar to the forum. As a commercial center, it enabled and assisted the Roman economy; and as a legal center it allowed for enforcement and application of law and encouraged a civil society. This was a more understated expression of empire, as is indicated by the simple design of the structure. The large hall, characteristic of the basilica, was made possible due to the risks taken by the Romans in its construction. The Greeks had used the truss concept, but the Romans employed its use more daringly, producing the imposing, unsupported hall of the basilica.

Baths

Vitruvius recommended the site for construction of baths to be as warm as possible, facing away from north and northwest winds, so that the caldera (hot room) and tepidaria (warm room) will have light from the west in winter. He instructed that care should be taken that men's and women's caldaria be connected and in the same area so a common furnace can be shared.[47]

A special feature of Roman bath construction was the suspended floor, which allowed heat to be circulated underneath to regulate the temperature of the floor. The introduction of this feature coincides with the introduction of window glass which occurred sometime in the late first century AD. The baths constructed prior to this were built with very small windows, causing the interior of the bath to be quite dark.[48]

Vitruvius provided the following instructions for the construction of the suspended floor:

> First, the floor is laid with one and one-half foot tiles that incline toward the furnace, so that if a ball is thrown in it cannot stay in place, but returns to the furnace on its own accord. In this way flame will circulate more easily under the suspended floor. On top of this piers of eight inch tiles should be placed so that two foot tiles can be placed over them. The piers should be two feet high and they should be mortared with clay mixed in with hair and over them place the two foot tiles, which will hold up the pavement.[49]

Vitruvius's instructions provided an insight into the complex construction techniques applied by the Romans. There does, however, seem to be a discrepancy. Sear describes the circulation type of construction to have begun late in the first century AD with the rebuilding of the Baths of Agrippa as the Baths of Nero. Vitruvius wrote the *Ten Books* between 30 and 20 BC. If he knew about this type of construction then, it is curious that the practice was not used until almost a century later.

Roman baths display the customs and style of living of a pleasure loving people. They were not only built for luxurious bathing, but were a place for social life, news, gossip, lectures, and games (board games, exercise, games with balls). The baths were an integral part of Roman life. Traditionally there was a small charge to enter the baths but some emperors opened them to the public free of charge. Baths were arranged with a central hall with the caldaria room, tepidaria room, and frigidarium attached. Several other services were available at baths ranging from barbers, manicurists, shampooers, and oil anointers. There was usually an open garden adjoining the bath and a running track and seats for spectators. Other adjoining structures contained lecture rooms, shops, and

housing for the many slaves who staffed the bath. The City contained most of the baths but baths were also constructed in Pompeii, North Africa, Germany, and England.[50]

The Roman baths provided a practical expression of empire because the baths were an essential component of the everyday life of Roman citizens and additionally part of the means of informal communication for the empire. Though not the focus of this paper, slave labor was a key factor in the enjoyment of life for the Roman citizen and would have been, as mentioned, critical for the operation of the bath. Pliny, Frontinus, Livy, and Vitruvius made reference to slaves on a limited basis and made clear the commonality of slaves in the Roman society. White, Sear, Adam, and Fletcher refer in fact to “numerous,” “hundreds,” and “large quantities” of servile labor. The purpose here is to acknowledge the role of slaves to the operation of these structures and their importance therefore in producing and expressing empire.

Baths were exported to the far reaches of the Empire and as a result their luxury was exposed to all the Empire. This would generate pleasure and enjoyment for the citizens who could participate and envy for those who could not. The baths of the Empire were a luxury, a trait of a pleasure loving populace. The origin of this need for pleasure was human nature but what provided it was the Empire. The wealth, innovation, and stability of the Empire allowed for this unique experience to be created.

Theaters

Similar in nature to baths, theaters were a means of entertainment rather than pleasure, but were also luxury experienced by the Romans *because* of the Empire. With basic needs provided, the populace was allowed to turn its attention to non-essential activities. The theater was one of several entertainment facilities produced by the Romans in addition to the amphitheater and the circus.

The recommendation for the site and building of theaters by Vitruivus is quite interesting. The theater should be built in the forum which is understandable as this was the primary center of activity. His initial concern is not about design or materials, but location, that the site should be as

> [h]ealthful as possible according to what I have written in my first book about the healthfulness of sites for laying out city walls. For the spectators as plays, sitting from the beginning to end with their spouses and children, are held captive by their enjoyment; because of their pleasure their motion-less bodies have wide open pores, in which the breath of wind can easily take hold. And if these winds should come from swampy areas of other unhealthy places, they will pour their harmful vapors into the spectators' bodies. And therefore, if the site for the theater is chosen with slightly more care, defects can be avoided.[51]

Roman theaters were adopted from the Greeks and were limited to a semicircle. They were usually on the side of a hill to allow the stepped seating to be arranged and constructed with some ease. Where an appropriate hillside was not available, the theater was constructed using concrete vaulting supporting the tiers of seats. In the case of vaulted construction, a shelter for inclement weather was a bonus.

There are numerous examples of these structures: The Theater Orange, in Orange, France, was built in AD 50, holds 7,000 spectators, and was constructed using a combination of concrete and the use of a hillside. The semicircle is 340 feet in diameter, the stage 203 feet wide, 45 feet deep. A portion of the stage wall remains with holes for masts that supported an awning over the stage.

The Theater of Marcellus in Rome, built in the last decade of the first century BC, was built on a level site so the construction is radiating walls of vaulted concrete. Theaters were constructed throughout the Empire: Herodes Atticus in Athens, Small Theater and Theater Osita in Pompeii, with others in Sicily, Florence, North Africa, and England. Theaters were constructed throughout the empire providing opportunities for entertainment for citizens. Entertainment would not have been contemplated nor possible had it not been for the power of the Empire.

Amphitheaters

The other entertainment venue for the Romans was the amphitheater. The modern interpretation of the amphitheater, a semicircle outdoor facility, was known to the Romans as the "theater," just described. The Roman amphitheater was what we now refer to as a stadium, or arena (Latin word meaning sand, which absorbed blood from the combatants). The amphitheater was a uniquely Roman invention for which they apparently did not rely upon Greek influence or design. Elliptical in shape, the amphitheater was built with rising tiers of seats making a continuous auditorium around a

central arena. Amphitheaters were found in every important settlement of the Empire and were a part of Roman life.

The most famous of all Roman amphitheaters, and possibly of all Roman buildings, is the Colosseum, Rome, completed in AD 82 after twelve years of construction. The Colosseum was constructed in a level valley between the Esquiline and Caelian Hills. The outer walls of the ellipse have a measurement of 620 feet by 513 feet, and the arena floor 287 feet by 180 feet. A podium at the floor level provided seats for the Emperor, Senators and other officials of state. Rising behind and around the podium were seats for 50,000 spectators. Below the seats were corridors and stairs for attaining the upper tiers. Outside are pins for securing ropes when occasion required a large fabric canopy be deployed to shade the spectators.

Construction of the Colosseum employed most all of the structural building materials available to the Empire. The foundation was concrete, and the supporting walls were constructed of tufa stone and brick. Travertine blocks secured together with metal clamps comprised the façade and marble was used for the seats and ornaments. The structural design of the building with wedged shaped piers radiating inwards supporting concrete vaults produced an exceedingly strong structure which has stood for almost two millennia. If not for scavenging for materials for other later structures, the Colosseum would appear today much as it did in the second century AD.

The exterior of the Colosseum is four stories tall, the first three floors of arches, arches, arches – a simple yet complex use of this architectural element that produces a magnificent appearance that remains impressive even when compared to modern

structures. Even though the amphitheater was original to the Romans, it employed many Classical elements of architecture. The Corinthian, Ionic, and Doric orders were all utilized in various places in the design.

The amphitheater's purpose was purely to provide entertainment, albeit there was a certain amount of related economic activity. Like the theater, the ability of this type of facility to exist was a result of the Empire, reflecting Rome's economic stability, military power, wealth, and capacity for innovation.

Circuses

The Roman circus was built to accommodate horse and chariot racing, and those built were grand and magnificent structures, exceeding the grandeur of the amphitheater. Due to its imposing size, one lane of the Circus Maximus reached almost half a mile. Chariot racing was very popular in Rome and much money was spent on horses and riders. Charioteers were the equivalent of modern celebrities and they were paid handsomely and as in modern times, betting produced even more interest.

The design of the circus was simple as banks of seats around the track were constructed by use of vaulted concrete, necessary due to the level site. The Circus Maximus, Rome, 46 BC, was the largest of the circuses and measured 2,000 feet in length, 650 feet in width and is estimated to have seated 250,000 spectators. A long straight lane on each side of a divider called a spina, provided the racing circuit. Like the Colosseum, the Circus Maximus' exterior was adorned with hundreds of arches.[52]

The theater, amphitheater, and circus provide excellent examples of the expression of empire through architecture and structures. The theater, amphitheater, and circus were venues for entertainment and produced desire throughout the region to participate in the pleasurable activity. But the structures, regardless of the activity conducted in them, were themselves monuments of empire, the size alone providing a powerful statement of empire. The Roman culture provided its citizens with remarkable experiences in social gathering and entertainment and at the same time expressed the strength, vitality, and authority of the Roman Empire.

Dwellings

There were four types of Roman dwellings: The domus or private home, the villa or country house, the imperial palace, and the insula or many-storied tenement.

The domus or private house combined features from the Etruscans and Greeks. An atrium (main hall of a traditional Roman house, roofed or unroofed, usually containing a water tank in the floor beneath) formed the public portion of the building with a courtyard, surrounded by apartments. According to Vitruvius the Greeks did not use atria. The Roman private house is dated earlier than the more public buildings with preserved examples going back to the third and fourth centuries BC. Private houses had water delivery via pipes and even though public baths were available, most of the larger houses had their own baths.[53]

Hadrian’s Villa is an example of the country house. Completed in AD 124, it is essentially a large park with buildings scattered throughout the seven square mile property. Hadrian’s Villa contains colonnaded courtyards, apartments, and halls. In addition to the Imperial apartment there were terraces, colonnades, theaters, and baths. All this combined for an opulent display of design and construction at the height of the Empire.

The imperial palace was impressive and imposing. Several palaces were constructed on Palatine Hill, above the Forum Romanum, by a succession of emperors beginning with Augustus. The palace contained public halls, a throne room, bathrooms, courtyards, and colonnaded gardens. A banquet hall, private social rooms with couches for reclining, fountains, floors with pictorial mosaics, and brightly painted walls were also included. The imperial palace was an exceedingly grand structure even by Roman standards.

The insula or tenement was common in Rome where the population was large and the available space limited. This was also the situation in Ostia, the port of Rome, where large numbers of workers had to be housed near the docks. Apartment buildings were built four, five, and sometimes more, stories high. The construction was brick faced concrete (opus testaceum), with trim in a darker color. This produced a structure quite modern in appearance (as is seen in renderings of reconstructions). Many had balconies made of concrete or wood. The buildings had numerous windows facing alleys and streets, and were constructed with internal garden courts. Fletcher says window glass was rare, so folding shutters would have been used to cover windows when necessary.

Pliny discussed the use of transparent glass in the first century AD and Sear reinforces this by stating the use of window glass began about that time.

The first floor of the tenement was used for various shops such as bakeries and craft shops. Although piped water was supplied, it did not reach upper floors of some tenements so some dwellers had to use street fountains.

Of all the types of dwellings of Rome, the tenement and the palace provide the greatest opportunity for expression of empire. The domus and villa, though impressive, were both rare and the villa so removed from the populace as to be virtually invisible. The imperial palace and the tenement, however, provided for expression of empire although in very different ways. The palace was the very essence of imperial Rome: opulent, grand, extravagant, and excessive – all the things associated with wealth and power. A physical location, high on the Palatine Hill in the center of the City, reinforced the importance, wealth, and power of the emperor, a perfect representative of the Empire. The tenement, a dwelling for those on the opposite end of the social strata, was still an effective expression of empire because the tenement would have been a source of pride that the empire could provide housing for its citizens and with a structure that was visually pleasing and able to house several families in one structure.[54]

Bridges

Bridges for roads were spectacular and significant construction works and had their place both in the landscape and in a city. Many bridges constructed during the

Empire are still in use today. The bridge's contribution to the idea of empire was significant. Transportation was an essential element of commerce and military needs. The ability to move armies and products across rivers was critical to the expansion of the Empire.

The earliest bridges were constructed of wood, but are only confirmed by pictorial representation on Trajan's Column and on a mosaic in Ostia. Several stone bridges are still in existence so it is still possible to observe the method of construction. The most difficult task in bridge construction was the foundation and the piers. In areas where there were dry seasons the foundation and piers could be constructed during this time. In areas where water flowed continuously, cofferdams were used. Pozzolona cement was critical to the construction of bridge piers with its ability to "set" underwater. In order to reduce the impact of constantly flowing water, and potential damage caused by flooding, the number of piers was kept at a minimum and arches were constructed as large as possible. Cut-waters were placed ahead of the bridge piers to deflect tree trunks and debris that might be carried during a flood.

Not all bridges were constructed to cross water. Some were built to cross valleys and other uneven land areas. Setbacks in some aqueducts were also used as bridges. Viaducts, bridges over land, were constructed using multiple arches because the catastrophic flood threat was not as great as for the river/water crossing. Bridges also often had a monumental nature due to their placement at city entrances, and along points of passage and they were often accompanied by triumphal arches.

An essential activity of the Empire was transportation and the bridge provided a critical component of this activity. The arch, again, provided a critical construction and architectural element in the design and construction of bridges. Roman capacity to speed the movement of armies and delivery of products, due in part to the bridge, served the Empire as a vital resource.[55]

Aqueducts

Roman aqueducts have been the subject of much study and are familiar even to the casual observer. An adequate water supply was of primary importance to the Romans. Vitruvius devoted Book Eight of the *Ten Books of Architecture* to water. He began by instructing on how to find water, by obtaining water from rain, from rivers, and from springs. He then explained the various methods of testing to determine if the water is of a suitable quality. In chapter six Vitruvius discussed water supply and provided his recommendations regarding the delivery of water: “There are three types of watercourses: in open canals with masonry channels, or lead pipes, or terracotta tubing. These are the principles for each: for channels, the masonry should be as solid as possible, and the floor of the watercourse should have a slope calculated to be no less than half a foot every hundred feet. The masonry should be vaulted so that the sun touches the water as little as possible.” The remainder of Vitruvius’ recommendations regarding water delivery are related to piping and trenching. It seems odd that Vitruvius would devote so little space to aqueducts, if it can be concluded he was referring to them at all. Aqua Appia, Aqua

Anio Vitus, and Aqua Tepula were all constructed from the fourth through the first centuries BC so he must have been aware of the concept. Most aqueducts were built during the Empire so Viturvius' knowledge of them could have been limited, or his perception of their importance could have been negatively influenced.[56]

Below is a listing of Roman aqueducts and their length.

Rome:

Appia	16 miles
Anio Vetus	40
Marcia	56
Tepula	18
Julia	14
Virgo	20
Alsietina	20
Claudia	42
Anio Novus	53
Traiana	36
Alexandria	22

Lyon:

Mont d'Or	17 miles
Craponne	15
Brevenne	41
Gier	13

France:

Arles	29 miles
Metz	13
Nimes	31
Saintes	4
Sens	28
Strasbourg	12

Germany:

Cologne	59 miles
Trier	13

Switzerland:

Aventicum	5 miles
Geneva	7

Spain:

Segovia	9 miles

Africa:

Carthage	52 miles
Cherchel	28

Italy:

Bologna	12 miles

Turkey:

Pergamon, Kaikos	31 miles
Pergamon, Madradag	26 [57]

The list above describes 781 miles of aqueduct built in every province of the Empire except England. Nine of the eleven aqueducts into the city of Rome were built during the Republic and parts of those were underground. The great majority of the aqueducts, especially those in the provinces, were constructed during the Empire. Due to this dating, it can be concluded and observed, construction is of concrete, stone, and brick.

The feature that gives the Roman aqueduct its visual identity, in my view, is the arch. The Romans' use of repeated arches, essentially a modular system of construction allowed them to build an aqueduct of indefinite length, and this is what they basically did with the spans across the plains. Concrete, stone, and brick, along with an ample supply of labor, enabled the expansion of this water delivery system. But it is the arch that is the trademark architectural feature that allows the aqueduct to be the most powerful expression of empire produced by the Romans. The arch, with its ability to sustain loads in far greater amounts than post and lintel construction, allowed the aqueducts to serve as bridges at some river crossings. This, however, is a secondary consideration. The visual impact of thousands of arches supporting the remains of aqueducts endures today. Aqueducts delivered to Rome the essence of life, and to do this consistently and reliably demonstrated the absolute power -- and the advantages-- of the Empire. Outside of the City were some 500 miles of arched aqueducts in virtually every province. The Romans, indeed did not invent the arch, and as previously noted scholars are in dispute as to what culture should be given credit, but the Romans made great use of the arch as a method of construction, a feature of architecture, and deliverer of the vital requirement of life, and it remains one of the Empire's most identifiable expressions of empire.[58]

CHAPTER SIX

THE GLORY OF ROME TODAY

This section will review selected sites across Europe where ruins of the Empire remain. While the term “ruins” is generally applied to remnants of the Empire, some are in serviceable condition and are used in the 21st century for the purpose of their original construction. For example, Le Pont du Gard aqueduct and bridge in southern France, while it is out of service as a functioning bridge, its structural condition is very good and could still be used as a bridge if not for the tourist attraction it has become. Austria, France, Great Britain and Italy contain examples of the types of structures built by the ancient Romans. Other ruins can be found in northern Africa and the Middle East but this review will focus on the above referenced locations.

Vienna, Austria

Vienna is situated on the eastern edge of central Europe. Called one of the great capitals of Europe, it was founded as a Roman military encampment around the beginning of the 2nd century AD. Not as distant from Rome as other far reaches of the Empire, it is still a considerable distance from the City. The Roman encampment was maintained for about 400 years but the Romans eventually abandoned it. Vienna survived, despite the Roman withdrawal, and by the 13th century was becoming the city we know today. Vienna contains an interesting Roman ruin, due partly to its location.

Located in the Hoher Markt (*sic*) Square in the heart of the oldest part of the city, the ruin contains part of a city wall and a portion of aqueduct. This writer was privileged to actually see this ruin on a trip that began in Vienna in 2009. The ruin is below the current street level so great care was required to preserve it. It could have been easily built over, but has remarkably been maintained despite at least seven centuries of development in central Vienna. This ruin provides a good example of *opus incertum* construction.

While Salzburg doesn't have any specific Roman ruins, it does have a Roman connection of sorts. Because of its baroque architecture, and its revival as an arts center following the end of World War II, historians refer to Salzburg as the German Rome.[59]

Great Britain

Two well-known Roman projects are located in England. The city of Bath, named for its namesake, the Roman spa, and Hadrian's Wall.

Roman spas were constructed in places other than Bath, but the spa at Bath is one of the best preserved. The city of Bath is a little over one hundred miles west of London. The Roman baths have attracted tourists for centuries and continue to do so today. The Romans constructed the spa, and a temple, in the 1st century AD based on the legend that a prince had been cured of leprosy by bathing in the mud there. The site was sold in the 11th century and expanded to include a cathedral. However, it will always be associated with its Roman originators.

The baths are fed by a spring which supplies 250,000 gallons per day of 116 °F water. The Roman site included the Great Bath, a large warm swimming pool, originally covered but now open, and two additional baths of varying temperatures. Three additional rooms were added: a *frigidarium* (cold room), *tepidarium* (warm/cool room), and a *caldarium* (hot room).

After the Romans left, the complex fell into disrepair, drains became clogged and the site became covered in mud. Subsequent renovations over several centuries have produced a site which continues to be popular with tourists. This site is a particularly good example of modern ruins evidencing the power and glory of Rome. Although across twenty-six miles of the channel the Romans created a spa which provided great pleasure for its citizens who were residents of that area. This was a display of power in the 1st century AD, and remains a display of Rome's greatness, extensiveness, and power in the 21st century.

Hadrian's Wall, one of the best know Roman ruins, runs from Newcastle on England's eastern North Sea shore 73 miles across to Solway Firth, on the western shore, just past the city of Carlisle. The location is slightly south of the Scottish border. Approximately sixty miles of the Wall remains today.

The Wall was constructed in 2nd century AD under order of Emperor Hadrian who was concerned with encroachment and unrest in many areas of the Empire and was determined to retain order. Constructed primarily of stone, when originally completed the Wall was accompanied by a parallel service road and a ditch, all of which comprised a military zone. The Wall became a United Nations Educational, Scientific, and Cultural

Organization (UNESCO) World Heritage site in 1987, further emphasizing its place as a symbol of the power and glory of Rome.[60]

France

Lyon probably offers the best example of Roman ruins in France. Located in eastern France at the convergence of the Saone and Rhone rivers, Lyon was founded as a base camp for Julius Caesar's conquest of Gaul. Later, under Augustus, Lyon became the capital for the Empire's "Three Gauls," Aquitaine, Belgium, and the province around Lyon. Lyon was also chosen by the Empire to be the hub of the road system for Gaul. It was also a manufacturing center for the Empire during the 1st century AD, primarily producing pottery. Roman ruins in Lyon consist of most of the Roman structures discussed previously: an imperial palace, capitol (with adjacent forum), a theater, an odeon (small theater), baths, a circus, several temples, as well as an amphitheater. From the effort expended by the Empire and the compliment of ruins remaining, it is clear to see Lyon held a significant place.

Across France, southwest of Paris, lies Tours. Tours' contribution to 21st century Roman remnants is limited, even though during the 1st century AD, Tours was a trade and administration center for the Empire. Regrettably, the western wall of the city is the only vestige of Roman presence. Tours does, however, due to its western location, demonstrate the extent to which the Empire covered France.

Just off the central Mediterranean coast, the town of Arles provides several truly exceptional examples of Roman ruins. Arles was founded by the Greeks, possibly as early as 6 BC and later came under Roman rule. The Romans constructed a canal linking Arles to the sea, making it an important port and eventually an administrative and political capital of Roman Gaul. The Romans constructed many buildings in Arles, many of which remain. The *Theatre Antique,* constructed at the end of the 1st century BC is one of the most important of surviving Roman theaters. Also in Arles is a 20,000 seat amphitheater (arena) constructed about AD 75, about the same time that the Colosseum in Rome was completed. The amphitheater in Arles is in particularly good condition due to its use as a fortress in the 5th and 6th centuries. The amphitheater, theater, and odeon were entertainment venues in important Roman cities. That these were included in Lyon and Arles is a testament to their importance to the Empire.

Just north of Arles is Nimes. Nimes was also the site of many Roman structures including theaters, temples and baths. Two significant structures remain, an amphitheater and a temple. The amphitheater is notable for its extraordinary precision stonework. It's still used today as a bullfighting arena. The temple in Nimes, the *Maison Carree,* is an incredibly preserved example of the Roman temple displaying all the features shown in Figure 3. Both of these were constructed during the reign of Augustus.

The town of Orange is notable for its *Theatre Antique,* and was also constructed during the reign of Augustus, and considered to be the best preserved structure of its type in all of the Roman world. Originally faced with marble, the structure remains essentially intact.

Nimes, Arles, and Orange form a triangle in southern central France near the Mediterranean coast and contain an incredible display of Roman architecture and construction. These remains are preserved in very good condition and some of them still in use for their originally intended purpose.

Also contained in this triangle is Le Pont du Gard, a tri-level bridge and aqueduct combination displaying the power and prestige of Roman achievement. Built in the 1st century AD, the bridge/aqueduct is constructed of stone blocks of tiered arches without the use of mortar.

Lyon, Tours, Nimes, Arles, and Orange are spread across France and contain excellent examples of the power and glory of the Roman Empire. All of the amenities of Rome were included in these outposts of the Empire's capital. France is surprisingly filled with evidence of the glory of Rome.[61]

Italy

Roman ruins in Italy present a bit of a puzzle. The city of Rome is filled with remnants of Rome, but in other parts of the country they are curiously sparse. Several smaller towns in Italy: Ferrara, Gubbio, Lucca, Parma, Leece, and Padova, for example, were founded by the Empire, but most of their notable construction occurred during the middle ages. There *are* notable sites in Italy, but most are Rome and its immediate area. The cities of Ravenna and Paestum have some good examples, but the most significant site outside of Rome is the Villa Adrianna in Tivoli.

Ravenna, with a strategic location on the northern Adriatic coast, was made capital of the Western Empire by the Emperor Honorius in AD 404. Ravenna's contribution to Roman glory is its collection of mosaics. Created by the Hellenic-Roman school (realistic) and the Byzantine school (stylized), the mosaics of Ravenna became a UNESCO World Heritage site in 1996. The mosaics of Ravenna date from the 5th century AD which puts them very late in the Empire. The Empire created most of its expansion and construction between the 1st century BC and the 2nd century AD, so by the time Ravenna became capital, the Empire was well into its decline, leaving little opportunity for the grand projects of the previous centuries.

Paestum, on the eastern coast south of Pompeii, contrasts with Ravenna in that it was founded by the Greeks in the 5th century BC and contains ruins of the typical Roman city features. A forum, amphitheater, and three temples, all regrettably in decay, are notable ruins at Paestum.

Pompeii, destroyed by the eruption of Vesuvius in AD 79, was founded in the 8th century BC, which places it before the founding of Rome itself. Pompeii did not come under Roman rule until 80 BC and then quickly became a Roman resort. Pompeii then adopted Roman customs, language, lifestyle, and building methods. Much of Pompeii was destroyed in the eruption, but an amphitheater, theater, odeon, forum, and baths have been excavated and are in remarkably good condition.

The most impressive site in Italy, outside of Rome, is the Villa Adrianna in Tivoli, just east of Rome. Designed by the Emperor Hadrian, it was constructed in the first century AD and has been described as probably one of the richest building projects

in antiquity. Visitors are advised to reserve an entire day to see the Villa and are provided with a model of the site to assist with their tour. Hadrian visited every part of the Empire and with his passion for art and architecture wanted to recreate what he had seen in his travels in a central location. Hadrian died four years after completion of the Villa and regrettably it then went into ruin. It was not until the 19th century that the Italian government authorized excavation of the site and revealed the magnificent complex, now a UNESCO World Heritage Site.

Villa Adrianna has several component structures. At the center of the complex is the Pecile, an area containing a large swimming pool surrounded by a portico and gardens. Another area, called the Teatro Marittimo, consisted of a central building surrounded by a canal. This particular area, especially the central building, was a favorite of Hadrian because of the solitude he could experience there.

Villa Adrianna contained over thirty buildings and might be considered sort of a mini Rome. Among other component structures are baths, the imperial palace, a theater, library, infirmary, and multiple temples. There was also a network of underground passageways to pass among the different areas.[62]

The modern city of Rome retains the most recognizable symbols of the Empire and the most notable of all is the Colosseum. In the heart of ancient Rome, at the southeast end of the Forum, the Colosseum is one of the most enduring symbols of the Empire. Its construction and architecture are discussed elsewhere in this paper, but the stone and brickwork, arches, and columns are worthy of additional notation. The Romans built amphitheaters in cities throughout the Empire, but the Colosseum in Rome

was by far the largest. Opened in the late first century AD and estimated to have 50,000 seats, the Colosseum saw duels between gladiators, gladiators and animals, re-enactments of naval battles, and animal acts similar to a circus. Inside the Colosseum the modern visitor can see the passageways and rooms where the combatants waited before their performance. They were brought to the arena floor by way of lifts and elevators. A portion of the elliptically shaped floor has been recreated so the visitor can imagine how it might have appeared originally. The spectacles staged at the Colosseum usually began in early morning and lasted until dusk.

The Colosseum began to be quarried for its stone in the 15th century for other structures that were being constructed in Rome, St. Peter's Basilica being one of them. Pope Benedict XIV stopped the pilfering in the 18th century because he thought Christians had been martyred there. Although commonly believed, Christians were never in fact martyred in the Colosseum.

Located northwest of the Forum, also in the heart of ancient Rome, is Trajan's Market. Trajan's Market contained about 150 shops for retail and was a center for the acquisition and distribution of goods and services administered by the imperial authorities. Via Biberatica (Biberatica Street) runs along the upper level of the market and the street name suggests there were taverns in this part of the Market. Trajan's Market suggests the existence of vibrant commerce in the Empire and is a testament to Rome's power as a center for the distribution of goods and services.

The Forum, just a few steps from the Colosseum, has now decayed into a sea of columns, crumbled walls and remains of commemorative arches. The Forum, at its

pinnacle, was the intellectual, social, economic, and political center for western civilization. The Forum was replicated in cities throughout the Empire to serve as a center for communication, exchange of ideas, and political activity. Over the centuries of the Empire, the Forum was added to and rebuilt for reasons of necessity such as fires, etc., but more importantly because of the Empire's increasing power. A visit to the Forum allows one the perspective to fully appreciate the size and scope of the Forum and imagine the high level of activity that would have take place there.

A few blocks away from the Forum stands the Pantheon, which is remarkably intact. The Pantheon is one of the grand remaining structures of ancient Rome. The design of the round main building with its porch entrance is an unusual combination in all of Roman ruins. The most impressive feature of the Pantheon is the interior's domed coffered ceiling with its center *oculus* (large round opening) providing light for the interior. It is remarkable the Pantheon has remained intact over the centuries. Barbarians sacked the Pantheon in the 4th century but it was ultimately saved from destruction by Pope Boniface IV who received the Pantheon as a gift from the Byzantium Emperor.[63]

The Colosseum, Trajan's Market, the Forum, and the Pantheon are the most significant ancient Roman ruins in the modern city of Rome. They receive thousands of visitors each year. They represent the essence of Rome by way of their construction, architecture, and impressiveness. Even after two millennia they remain symbols of the power, glory, and abilities of the Roman Empire and of western civilization. But as has been demonstrated above, the Romans spread their influence over Europe by building

theaters, amphitheaters, temples, basilicas, resorts, baths, and more, in each location conquered and brought into the Empire.

Edward Gibbon

The monumental work of Edward Gibbon, *The Decline and Fall of the Roman Empire*, provides a demonstration of the power and glory of Rome that is enduring until today even if it is not directly related to buildings or architecture. It *is* related to the power and glory of Rome, but a different kind of power and glory. Two chapters of Gibbon's work, the fifteenth and twentieth, discuss a phenomenon that occurred while the Empire was beginning to crumble. The phenomenon was the rise of Christianity. Was this coincidental to the decline of the Empire, or was it the cause of the decline? This one question is a suitable subject for a thesis or dissertation.

Gibbon begins his description of the fall of the Empire in the first and second century AD. Gibbon further describes the extent to which Christianity spread in subsequent centuries to all the nations of Europe, and because of European ambition, to Asia, Africa, and North and South America. The ancient Romans could have never known the Empire would have spread to such places, albeit not necessarily the empire they would have wanted to be spread.[64]

Gibbon asks the question, how did Christianity grow and how did it prevail over the pagan religions of the Empire. He offers five reasons: the zeal of the early Christians, the doctrine of a future life, the miracles ascribed to the primitive church, the pure morals

of the Christians, and the discipline of the Christian republic which formed an independent state within the Empire.

During the time of the Empire most of the ancients respected each other's beliefs except for the Jews who, despite persuasion, would not associate with the mythology of the Greeks. The Romans, who practiced universal toleration, protected the Jews' religious practices and the Jews maintained exclusivity while being at odds with the pagans. From the beginning of the world the Jews had anticipated the coming of the Messiah to be a king and conqueror rather than a martyr, prophet or the Son of God. His sacrifice removed the sacrifices of the temple and out of this grew the church and Christianity, which ultimately took over the Roman Empire to cover the world as it was known then.

To further strengthen the institution of the Church and establish it as a public institution the conversion of Constantine is a vitally important event. Several dates are attributed to this event by different ancient historians. Lantanius states Constantine proclaimed his faith at the moment his reign began in AD 306. Eusebius places it at AD 312 upon the appearance of a sign when he was preparing an expedition. Zosimus places the conversion at AD 326 upon the death of his son. The Church attributes Constantine's conversion to the moment of his death in AD 337, maintaining he was not worthy until then. Regardless of the date of his conversion, Constantine was the first Christian emperor of the Empire.[65]

So the Empire declined but also simultaneously the Empire grew in very different ways and directions. The remnants of the pagan empire divided, faded, and blended with other empires and nations over centuries. Ironically it was Christianity that slowly replaced Rome to dominate the original empire, and spread to every region of the globe. The power and glory of Rome demonstrated in the 21st century in a way never dreamed by the ancients.[66] While Gibbon, good Enlightenment thinker that he was, did not appreciate Christianity's intersection with the Empire, his famous book confirmed and further popularized the idea of Rome's "empire."

CHAPTER SEVEN

CONCLUSION

The Roman Empire ultimately controlled a land area that is relatively small when compared to nineteenth century European empires. But this area was essentially the Western world at that time, and the influence exerted by Rome has endured 2,000 years. In the third decade of the first century BC, Rome emerged from a Republic to become an Empire, lasting to around the fifth century AD. The objective of this paper is not to identify why this happened but how the materials and structures created as a result expressed, served, and identified the Empire and the idea of empire that was created. The majority of construction that formed the tangible empire was produced in the first century BC and the first and second centuries AD. The structures built by the Empire, many of which remain today in ruin and many of which are still in use for their intended purpose, identify *Rome*.

The materials used to produce the structures of the empire were stone, brick, timber, glass, and concrete. Of these, the most significant were brick, specifically baked brick, and concrete. Brick could be manufactured in large quantities and assembled by skilled laborers who could repeat the masonry process quickly. Concrete enhanced brick construction by providing a strong core which, when constructed, was exceedingly durable, as is evidenced by some of this construction intact after two millennia. The use of concrete in vaulted construction allowed the Romans to produce a variety of structures,

especially multiple rows of seating, not possible without this technique. Concrete made using pozzolona cement, with its ability to cure underwater, allowed the Romans construction possibilities not previously contemplated. The role of concrete as an expression of the Roman Empire cannot be overstated. It is no small mystery why the ability to produce concrete disappeared after Roman use and did not reappear until the middle of the eighteenth century. Its practical application may have faded with the Empire or it may be as simple as a lost formula.

Rome and other cities of the Empire consisted of buildings that included basilicas, temples, theaters, amphitheaters, dwellings, baths, and marketplaces. Architectural features included pitched roofs, colonnades, arches and porticoes. Extensive detail was produced in pediment, frieze, cornice, architrave, and many other architectural elements. To identify a single element, it is the arch, not only an architectural feature, but also a method of construction, that was the most powerful and visible expression of empire. The arch could not only be constructed repeatedly, but the materials used in their construction, primarily brick and concrete, were mass produced and assembled quickly. With ample available labor, the arch spread across the Empire in the construction of aqueducts, amphitheaters, theaters, and circuses.

But it was not the arch alone. A combination of mass produced, uniform materials; repeatable, standardized methods of construction; and architectural style utilizing the arch, colonnade, dome, portico, and pediment, with their associated details; identified, served, defined, and expressed the Roman Empire.

The world of the 21st century continues to be influenced by Rome. As reviewed in the final chapter, the physical remnants of Rome can be found across Europe. There are the baths and Hadrian's Wall in Britain, excellent examples of theaters and amphitheaters in France, and remains of fortifications and city walls in Austria. In Italy resorts and villas allowed the Romans to enjoy luxurious pleasures. In Rome the Colosseum, Pantheon, and Forum provide modern visitors examples of the most impressive works of the Empire. And lastly, Christianity, born out of the Empire is an ironic extension of what began as the legend of Romulus and Remus in 750 BC. The power and glory of the Roman Empire continues to influence the globe.

NOTES

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